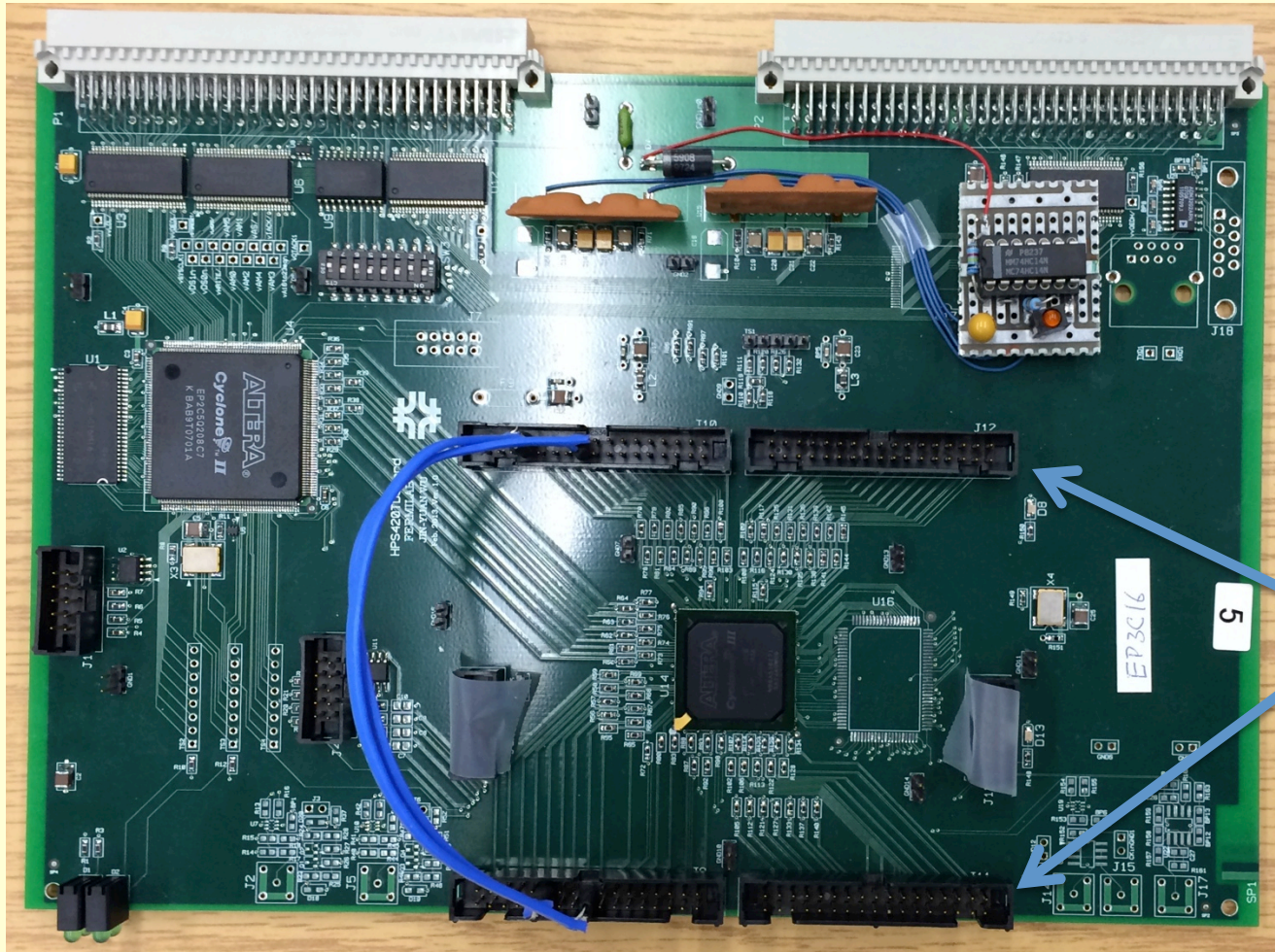# LArIAT TOF Readout

Wave Union TDC (Jinyuan)

15.625 ps LSB
52 bits time

Discriminator
mezzanine
plugs in here

LArIAT TOF WU TDC

Ran WU TDC at test beam last week successfully with in beam PMT TOF signals

- Iterating with Jinyuan for refinements at fixes
- Need redefinition of time start
  - Currently expects EOS signal
  - But that initiates two second self-calibration sequence
  - Has long delay before store ~ 56 seconds
- Request BOS beginning of store input
  - Programmable delay when calibration starts
  - And/or user requested calibration via VME
- Need channel enable mask
  - Channel 0xB on late Friday became noisy, occluding real hits from PMT
  - Reminder: Have 8 analog input channels

LArIAT TOF WU TDC Readout

- Automatic self calibration simplifies programming
- Readout device driver written and tested, included in main LariatReadout application
- Total readout timing, header + payload, 512 data words (32 bit)
  - Single word controller, single word VME: 5 millisec
  - Grouped controller list, signal word VME: 1.6 millisec
  - Slow by modern standard, but sufficient for us
- Problem with block transfer (BLT) readout
  - Have asked to fix VME BLT address increment
- Worse case data rate: One hit per 12 μsec generates three 32-bit words in buffer
  - $\Rightarrow$ 170 hits per buffer
  - Still OK for our rates, reading during spill ~ 85 kHz (not counting other intra spill activities)

LArIAT WU TDC TOF Data Sorting

- No natural concept of trigger in WU TDC
  - Designed for continuous readout
- But we can easily readout entire spill > 10 kHz rate
- With 52 bits of timing information, 4 second spill easily fits
- But hits will have to be aligned with other readout using the full timestamp, not easy at front-end
  - ArtDaq has no concept of non-event aligned data
- Data come in chunks of 12 μsec *Time Frames* :
  - Header word with coarse time
  - Followed by *nHits* words with channel and fine time
  - Zero trailer word
- Have asked to eliminate zero trailer word
- Frames with no hits produce no data buffer words